



PARTIAL ENGLISH TRANSLATION OF JP 08-285280

[0028] In the punching process (E), a hole 53 that extends from an end surface 51 side to an end surface 52 side is formed, and the inner surface 53a of the hole 53 is processed by ironing. At the end surface 52 side, a hole 54 remains a little as a mark of the second center hole 44, and inside the hole is formed a punched hole 54a (hereinafter referred to as breakage portion). If the punching process is performed without forming the second center hole 44, a breakage surface of that has been described with respect to the prior art is formed at the hole 54 portion. Since the breakage surface cannot be amended or corrected by the following processes if positioned on the end surface 52 side, formation of the second center hole 44 in the aforementioned first forming (D) is a quite important process. Further, a punched piece 54b produced by this process is pushed into a blade portion 56 and then send forward by punched pieces 54b sequentially formed and pushed thereinto and thrown away since there is provided a larger hole behind the blade portion 56.

[0029] Then, a fourth material 50 inserted into a fifth die hole 67 is extruded forward and toward an ironing pin 69 by being pushed at an end surface 52 by an end portion of a hollow punch 65. The leading end of the ironing pin is a little larger than the hole 53 and forms a smooth hole 63 that extends from the end surface 61 side to the end surface 62 side by subjecting the hole 54 and the breakage portion 54a as well as the hole 53 to an ironing process.

[0030] By the process described above, the pipe material 60 is formed, and a cylindrical body having a hole 63 and an external shape which are concentric. Further, the cylindrical body is formed into a housing for a glow plug, and its forming process is described in detail in JP2-642 but the forming process using the pipe material 60 will be described.

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[0031] The pipe material 60, after its forming is completed by the aforementioned hole inner surface smoothing process (F), is inserted into a sixth die hole 77 by a transfer device and is formed with a first smaller diameter section 74b that is smaller in outer diameter, by a first punch consisting of an outer punch 76 and a core metal 75, when the core metal having a spherical leading end and protruding from the outer punch is inserted into the hole 63 and the leading end of the outer punch 76 is brought into contact with the end surface 62 to push, thereby causing the pipe material to be pushed, from the end surface 62 side, into a protrusion-like drawing section 77a formed at a die hole 77 and thereby be subjected to ironing. Accordingly, the hole 73 does not vary in diameter as compared with the diameter of the hole 63 processed at the last time, but by ironing, the overall length including the long first smaller diameter portion 74 and a remaining section 74a that is not subjected to ironing, is made larger. Since the first smaller diameter section 74b is extruded in the direction of 74a, there is caused at the ironed outer side a structural flow in the direction opposite to the direction of extrusion, the hole 73 is subjected to a compression force, thus causing the hole 54a section formed with the breakage portion to move a little toward the end surface 72 side. Further, at the time of the extrusion process, a pushing force is applied to the end surface 61, so that the end surface 61 is formed into a smoother end surface 71. When the first punch withdraws, the end surface 72 is pushed by a knockout pin 79 for thereby pushing out a first formed article 70 which is then clamped by a chuck (not shown) standing ready at the sixth die hole 77 and inserted into a seventh die hole 87 for the next processing.

[0032] In a second drawing process (h), a second punch consisting of an outer punch 86 and a core metal 85 that is thinner at a leading end than the aforementioned hole 73 is provided, the

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leading end of the core metal 85 is inserted into hole 73 and the end portion of the outer punch 86 is brought into contact with the end surface 71 to push the same. By this, the first formed article is pushed, from the end surface 72, into a second drawing section 87a formed at the seventh die hole 87, thus causing the first smaller diameter section 74b to be formed with a second smaller diameter section 84c. Namely, a second formed article 80 consisting of end portions 81 and 82, a first smaller diameter section 84b(2), a second smaller diameter section 84c(3), a tool engaging section (1) which will be described later, and a remaining section 84a is obtained. The article is pressed at the end surface 82 side by a knockout pin 89 and pushed out to the aforementioned section drawing section 87a and claimed by a chuck that is standing ready and transferred further to a tool engaging section forming process (I). In the meantime, the hole 83a serves as a center insertion hole 7, the hole 83b serves as a cap fitting hole 8, the first smaller diameter section 84b serves as a threaded section 2 and the second smaller diameter section 84c serves as a smaller diameter section 3.